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The Moorleah Meteorite

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Plate IV

Abstract

The meteorite, an account of whose fall at Moorleah, near Wynyard, in October, 1930, has been supplied by the finder, Mr Hubert G. Watts, is the first to have been observed to fall in Tasmania, and is the first stone recorded from the State, the three Tasmanian examples previously listed all being irons. The specimen, an enstatite olivine chrondrite of specific gravity 3·51, and weighing upwards of 19 lbs, is here described and figured.

This is the fourth meteorite to be recorded from Tasmania. As the other three, Blue Tier, Castray River, and Lefroy, are all irons, this constitutes the first record of a stone. It is the only meteorite to have been seen to fall in Tasmania. Although it fell sometime in October, 1930, it has only just come under our notice, and we are indebted to Mr Hubert G. Watts for the following account of the event.

'In the year 1930, in the month of October, about 6.30 p.m., I witnessed the falling of a meteorite on my father's (Mr Fred Watts) property at Moorleah, which lies six miles west of Wynyard on the North-West Coast of Tasmania.

'When this occurrence took place it appeared as a streak of fire, travelling east to west. A loud explosion then took place, followed by ten or twelve smaller ones. These explosions were similar to the back-firing of a motor-car, and I could distinctly hear the whine of the meteorite as it came to earth. The whine resembled a bullet as it passes overhead and becomes spent. I am fully persuaded that there were other meteorites falling at the same time. No sooner one whine died away than another reached my ears.

'As my father was crossing his farm about 10 a.m. the following morning, he found a fresh hole in the ground in a grass paddock. On digging down about three feet he discovered the meteorite buried in the clay. It was then quite cold.

'At the time of the explosion I was standing about thirty chains from where my father found the meteorite. To the best of my knowledge no others have been found.'

The locality is situated approximately at Latitude 40° 58½′ S., and Longitude 145° 36′ E.

The stone is roughly pyramidal in shape with the apex of the pyramid truncated and roughly saucer-shaped. The base of the pyramid is only very slightly indented, while one of the sides is quite flat. The other two sides are somewhat irregular, while the junction between them is flattened, forming a small side with a maximum width of about five centimetres.

The base measures along the junction with the flat side 19 cm., and along the other two sides 18 cm. and 14 cm. The height is approximately 19·5 cm. The measurements of the edges of the truncated apex are 13 cm. along the flat side, 7 cm. and 6 cm. along the other two principal sides, and 5 cm. along the small side between them.

The weight of the stone, as received by us, was 8887·5 grams (19 lb. 9½ oz.). Two small holes had been driven into the two irregular sides. Apparently in drilling these a portion was nearly flaked off, and some material around the edges of this flake was lost, so that the aerolite probably weighed some thirty grams more.

The colour of the skin varies from red to brown to almost black. The darkest and most lustrous portion is situated on and around the apex. The thickness varies, so far as could be determined, from the thickness of paper to 0·8 mm. In one or two places, where the skin has been broken, there can be seen a further zone of alteration where the stony material has been stained a light yellowish-brown colour due to the oxidation of the nickel-iron. There is a tendency for this zone to flake off. It is about 2 mm. thick. The analysis shows traces of chlorine, indicating the presence of lawrencite, and it is probable that this alteration zone is due to ordinary atmospheric weathering. Some chondrules stand out like pimples on the surface. Apparently they can offer greater resistance to the heat produced by the friction with the atmosphere during the flight of the stone than the material of the groundmass.

The surface is largely pitted, but only on and near the concave surface of the truncated apex is the fresh slag-like pitted surface preserved. Here flow-lines can be seen, indicating that the molten surface material flowed toward the apex. Elsewhere the walls of the pits appear to have been weathered, and it is probably due to this fact that the surface is partly coloured reddish-brown. There are numerous minute cracks which, in places, produce a pattern of very irregular squares.

The portion that was nearly flaked off during the drilling operations previously referred to was broken off for analysis, etc. The colour of the freshly-fractured stone is light ash-gray, and the stone was somewhat friable.

In thin section the stone is seen to possess a granular to tuffaceous fabric. Chondrules are scarce and often broken. Some consist of very small laths of either olivine or hypersthene, arranged in parallel position, separated by fine dusty material and a little glass. These are arranged in more or less rectangular groups, which, under the low power, give the appearance of twinning. Others consist of lath-shaped olivine crystals. In the groundmass of fine angular fragments of both olivine and enstatite are porphyritic crystals of both these minerals. Olivine is the predominant mineral. Two small pieces of clinopyroxene are present. A fair amount of felspar is present, mostly untwinned. One large allotriomorphic mass of untwinned felspar was seen. According to the analysis the felspar has the composition $Ab_{65}An_{35}$.

The enstatite is optically positive. In a partial analysis of the soluble portion the olivine was found to have the composition $2Mg_2SiO_4.Fe_2SiO_4$. In working out the norm, it was found that no FeO remained after satisfying that required for the olivine molecule, so that in the norm the pyroxene is iron-free enstatite, and this agrees with the optical properties as determined under the microscope. This raises the question of the nomenclature as used by Prior (1920) in his classification. From the analysis, the Fe:Ni ratio is 7·2 and the MgO:FeO ratio is 3·2, so that this stone belongs to his Group three. However, it is not a hypersthene olivine chondrite, but an enstatite olivine chondrite. In other words, while there is a distinct relation between the Fe:Ni and the MgO:FeO of all the ferro-magnesian silicates, it does not necessarily follow that the relation of the magnesia to the ferrous oxide is the same in each of these silicates.

The opaque minerals observed consist of nickel-iron, sulphide of iron, and a little limonite. Baker and Edwards (1941) suggest that pyrrhotite as well as troilite may be present in stony meteorites, but we have made no determination of the iron-sulphides present.

Approximately 29 grams of material was taken for analysis. As the iron was in an extremely finely divided state it was impossible to make a clean separation of magnetic and non-magnetic material. It was decided to make the unattracted portion as free from metallics as possible. As a consequence, the attracted portion contained over 42 per cent of silicates. One point of interest is the fact that the iron-sulphide, though present in both portions, remained to a greater extent with the unattracted portion. The attracted portion weighed 3·9681 grams and the unattracted 24·9257 grams. From the analysis, the attracted portion consisted of—

Nickel-iron	54·35
Iron-sulphide	3·13
Olivine	19·87
Insoluble	22·56
	99·91

The results of the analysis are given in table I and the mineral composition calculated from the analysis is given in table II.

TABLE I

MOORLEAH METEORITE

ANALYSIS

Constituent	Attracted	Unattracted	Bulk Analysis	Molecular Ratio
SiO_2	7·87	43·58	40·39	0·673
Al_2O_3	....	3·27	2·81	0·027
Fe_2O_3	....	0·27	0·23	0·001
FeO	3·40*a*	15·46	14·13	0·199
MgO	8·60	27·54	25·89	0·647
CaO	....	1·74	1·49	0·027
Na_2O	....	1·58	1·32	0·021
K_2O	....	0·04	0·04	....
MnO	....	tr.	tr.	....
H_2O	....	0·06	0·05	....
Cl	tr.	0·01	tr.	....
P	....	tr.	tr.	....
FeS	3·13	6·79	6·27	....
Fe	47·74	....	6·68	....
Ni	6·35	tr.	0·89	....
Co	0·26	tr.	0·03	....
Insoluble	22·56	....	....	....
TOTAL	99·91	100·34	100·22	....

[a] Calculated to satisfy SiO_2 in olivine molecule.

Fe:Ni 7·2. MgO:FeO 3·2. Specific Gravity 3·51.

TABLE II

MOORLEAH METEORITE

MINERAL COMPOSITION

Albite	11·00	
Anorthite	1·67	
Felspar		12·67
$CaO.SiO_2$	2·32	
$MgO.SiO_2$	18·20	
Enstatite		20·52
$2FeO.SiO_2$	20·19	
$2MgO.SiO_2$	32·48	
Olivine		52·67
Iron-sulphide		6·72
Nickel-iron		7·60
Limonite, etc.		0·08
		100·26

SUMMARY

Moorleah. Enstatite olivine chondrite. Fell October, 1930.

Moorleah, six miles west of Wynyard, Tasmania.

Lat. 40° 58½′ S., Long. 145° 36′ E. Weight 8·88 kilograms (19 lb. 9½ oz.).

Main Mass: Queen Victoria Museum and Art Gallery, Launceston (Q.V.M. Reg. No. L.I. 1940. 76), 8·66 kilograms (19 lb. 1½ oz.).

Other specimens: Australian Museum, Sydney, 64·6 grams.

REFERENCES

BAKER, G., and EDWARDS, A. B., 1941.—*Mem. Nat. Mus. Vict.*, 12, 1941, p. 56.

PRIOR, G. T., 1920.—*Min. Mag.*, XIX, 1920, pp. 51-63.

PLATE IV

MOORLEAH METEORITE

Fig. 1.—View showing saucer-shaped, truncated apex, and the flat side.

Fig. 2.—View showing one of the irregular sides of the pyramid with the portion partially broken off. It was this portion that was used in the analysis, etc.

Fig. 3.—Slightly enlarged view of the slag-like surface of the truncated apex.

Fig. 4.—View showing flow lines on one side leading to the edge of the truncated apex.

(Photographs by G. C. Clutton)


Fig. 1


Fig. 2

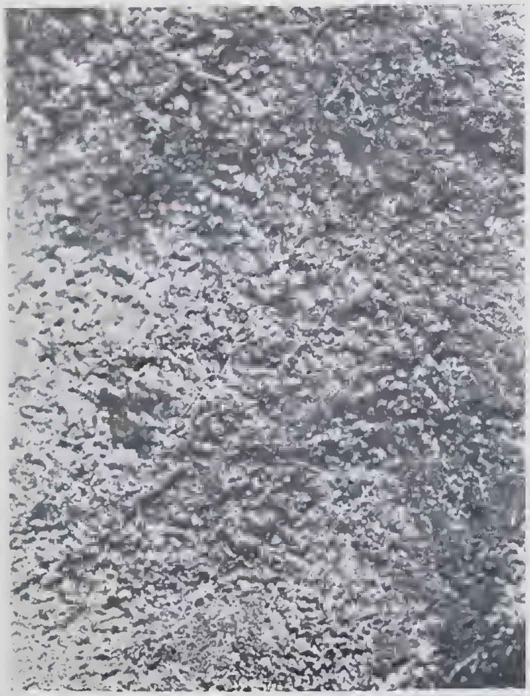
Fig. 3

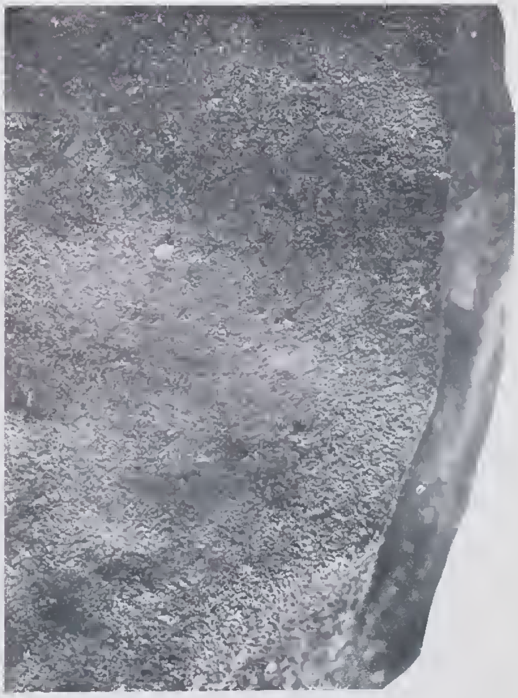
Fig. 4